**The integral test**

**Theorem:** (the integral test)

Let be a sequence of positive terms. Suppose that , where is a continuous, positive, decreasing function of for all (is positive integer). Then the series is

1. convergent if the integral  is convergent.
2. divergent if the integral  is divergent.

**Remark:**

1. The function is increasing on interval if .
2. The function is decreasing on interval if .

**Example:**

State whether the following series convergent or divergent

1.  (2) 

**Solution:**

(1)

Let . Then  , for all , is positive and continuous.

. Then the function is decreasing.

Then we can use the integral test.



then the integral diverges and so the series  is divergent.

(2) 

Let . Then  , for all , is positive and continuous.

. Then the function is decreasing. Then we can use the integral test.

 then the integral converges and so the series  is convergent.

**Definition** (P-series)

The series  is

1. convergent if .
2. divergent if .

**Example:**

1. The series  converges because .
2. The series  converges because .
3. The series  diverges because .

**Exercises**

Which of the series converge, and which diverge

(1)  (2)  (3) 

(4)  (5)  (6) 